PREDICTING ATTRITION OF UNITED STATES MARINE CORPS OFFICERS BY RANK AND MILITARY OCCUPATIONAL SPECIALTY

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THESIS

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by

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April 1970

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Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN OPERATIONS RESEARCH

from the

NAVAL POSTGRADUATE SCHOOL
April 1970

ABSTRACT

This thesis develops a model for the prediction of officer losses from the United States Marine Corps. The model is developed through the analysis of past data. From this analysis, the thesis shows what prediction values are required in order to develop the model. Some calculations are made to show the nature and scope of the required predictors. The author recommends that an operational model be constructed in order to better estimate the value of this approach to officer personnel attrition prediction in the United States Marine Corps

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I. BACKGROUND

Effective manpower planning requires detailed information on expected personnel changes, such as shortages, changes of job skills, and changes of location. These changes require that planners have sufficient advance notice of the problem in order that lead-time requirements can be met. Some personnel problems which require lead-times are:

1. Recruitment
2. Training requirements
3. Personnel budget projections
4. Job assignment
5. Promotion prediction

The purpose of the study is to describe a mathematical model which will predict the expected recruitment effort that is required in order to maintain a given manpower level of a particular organization. The model attempts do not only predict the quantity of manpower required but also the quality. The organization under consideration in this study is the United States Marine Corps Officer personnel system. The term quality is used in the sense that it denotes the type of job the officer is recruited to perform.

Since the model attempts to predict the location of a given individual member of an organization at some future point in time, it is necessary that it do so on a probabilistic basis. Hence, a

stochastic model, one which develops in time according to probabilistic laws, is used to describe the system.

The basis for the model is that for each increment of time, a decision is made as to whether an individual is still in the system or has departed from the system. As a Marine's career advances he is continuously faced with the decision to remain or to depart from the system; at the same time the Marine Corps has to decide whether to keep the individual or release him. And of course, there are decisions that cannot be controlled by either the individual Marine or the Marine Corps.

Before the model can be formulated it will be necessary to discuss the structure, the management, and past data relating to the Marine Corps Officer Personnel System.

II. THE UNITED STATES MARINE CORPS OFFICER STRUCTURE

The present active duty roster of Marine Corps Officers consists of the following type officers:

1. Regular unrestricted officer
2. Reserve unrestricted officer
3. Limited Duty officers
4. Warrant officers
5. Temporary officer (permanent warrant officer)
6. Temporary officers (permanent enlisted)
7. Temporary limited duty officer
8. Temporary warrant officer (permanent enlisted)

Temporary officers usually enter the system during times of rapid expansion of the officers Corps, such as the present Vietnam conflict. As such, they are used as a personnel administrative tool when cutbacks are required.

The Warrant officer is a special breed of officer; and since his recruitment is from the enlisted ranks of the United States Marine Corps, he was not considered within the scope of this model.

The only difference considered between a regular and a reserve officer was that a reserve officer carries an end of active duty (EAD) date, while a regular officer has an indefinite duty date.

A. DISTRIBUTION OF OFFICERS BY RANK

The Officer Personnel Act of 1947, with subsequent amendments, provides officer promotion machinery for the Army, Marine Corps, Navy and Air Force. The Navy and Marine Corps provisions are generally similar. One of the most important things which this law does is to establish certain categories of officers for promotion purposes, and to regulate the number of officers who may be assigned to each grade. This is known as "officer distribution", and determines how many vacancies for promotion each rank contains. The distribution of the number of officers allowed in each rank is based on the actual number of commissioned officers on active duty at the time of computation. The percentage allowed in each rank is:

General Officer	.75% (not more than half may be major General or above)
Colonel	6.00%
Lieutenant Colonel	12.00%
Major	18.00%
Captain	24.75%
Lieutenant (1st and 2nd)	38.50%

In addition, if the Secretary of the Navy decides that fewer officers than those computed are required in any grade, he may establish that lesser figure as the authorized number for that grade. If the allowance is not used at a given rank it may be used at a lower rank.

Limited duty officers (LDO's) are included in the percentage just given and the actual number of LDO's may not exceed the following percentages of the authorized number of unrestricted officers in each grade:

1.	Lieutenant Colonel	3.64%
2.	Major	8.62%
3.	Captain	7.72%
4.	Lieutenant (1st and 2nd)	6.04%

B. THE JOB STRUCTURE

Each Marine upon completion of his basic training is assigned to an occupational field. Upon completion of training within the occupational field he is assigned a specific job in that occupational field. This assignment is accomplished by use of a four digit number called a military occupation speciality (MOS). The first two digits represent the occupational field; the last two digits indicate the specific job within the occupational field. An example is an officer with MOS 0430, his occupational field is logistics (04) and (30) indicates he is an embarkation officer.

There are limitations as to the type of job certain officers can perform. There are also limitations as to which MOS's are available as initial assignments upon entrance into the United States Marine Corps. Appendix A has the complete list of MOS's and the category of officer who may be assigned to each Military Occupation

Specialty. The MOS's available as initial assignments are as follows:

0302 Infantry Officer

0802 Field Artillery Officer

1302 Engineer Officer

1802 Tank Officer

1803 Armored Amphibian and Amphibian Tractor Officer

2502 Communications Officer

3002 Supply Officer

3502 Motor Transport Officer

4002 Data Systems Automation Officer

4402 Judge Advocate

6702 Aircontrol/Anti-air Warfare Officer

6704 Anti-air Warfare Officer

6708 Air Support Control Officer

6709 Air Defense Control Officer

6720 Air Traffic Control Officer

7580 Student Naval Flight Officer

7599 Student Naval Aviator

As each Marine's career progresses he obtains additional MOS's which are maintained in the personnel files as secondary and tertiary MOS's.

C. PROMOTION POLICY

The Marine Corps, as do the other services, promotes from one rank to the next higher rank based upon seniority. Seniority is used in respect to the length of services spent in your present grade. The promotion system is an "up or out" system. Each Marine is given a number of tries at promotion and if not selected he must depart from the system.

There are special rules for the "up and out" policy for each rank.

D. ENTRANCE INTO THE SYSTEM (ACCESSIONS)

Since the Marine Corps is not tied to any academy for its main source of officers, there are many ways in which Marine Officers enter the system. Two broad categories are recruitment from within the system, and recruitment outside the system. The following sources are from within the system:

1. Enlisted Marine to officer status
    a. Enlisted selected for warrant officer
    b. Enlisted commissioning program
    c. Naval Enlisted Scientific Education Program
    d. Outstanding Combat leadership
    e. Enlisted selected for limited duty officer
2. Marine Reserve Officer
    a. Reserve officer assigned active duty
    b. Reserve officer selected for regular officer

while the following are recruited from outside the system:

1. Platoon leaders class
2. Officer candidate course
3. Service academy
4. Naval Reserve officer training corps

E. DEPARTURE FROM THE SYSTEM (ATTRITION)

It is inevitable that a Marine's career will end. The way you depart from the system falls into three broad categories as follows:

1. Individual's Request
    a. Retirement
    b. Resignation
    c. Revert to enlisted status
2. Marine Corps Request
    a. Disciplinary
    b. Promotion failure
    c. Release from active duty
    d. Revert to enlisted status
3. Uncontrollable
    a. Natural death
    b. War casualty
        (1) Death
        (2) Physical disability

F. SCHEMATIC REPRESENTATION OF THE SYSTEM

From the above description of the Marine Corps Officer structure it is easily summed by the schematic representation in figure 1.

The numbers given in the figure were actual numbers as of 31 July 1969. The arrows showing movement to the right indicate those Marines that leave the system for some reason or another, while an upward arrow indicates a promotion from a lower rank to the next higher rank.

The divisions shown within each block represent the different occupational fields. The multiple upward arrows from Lieutenant Colonels indicate that some occupational fields merge at the rank of Colonel.

Virtually all Marine Officers enter the system at either Second Lieutenant or First Lieutenant as shown on the diagram.

It is easy to see that the number of Colonels that can be promoted is equal to the number of Generals that left the system. The number of Lieutenant Colonels that can be promoted is the sum of number of Colonels promoted and the number of Colonels that left the system. The number of recruitments needed is the summation of those who have left the system from all ranks; provided that the total number of officers required remains constant.

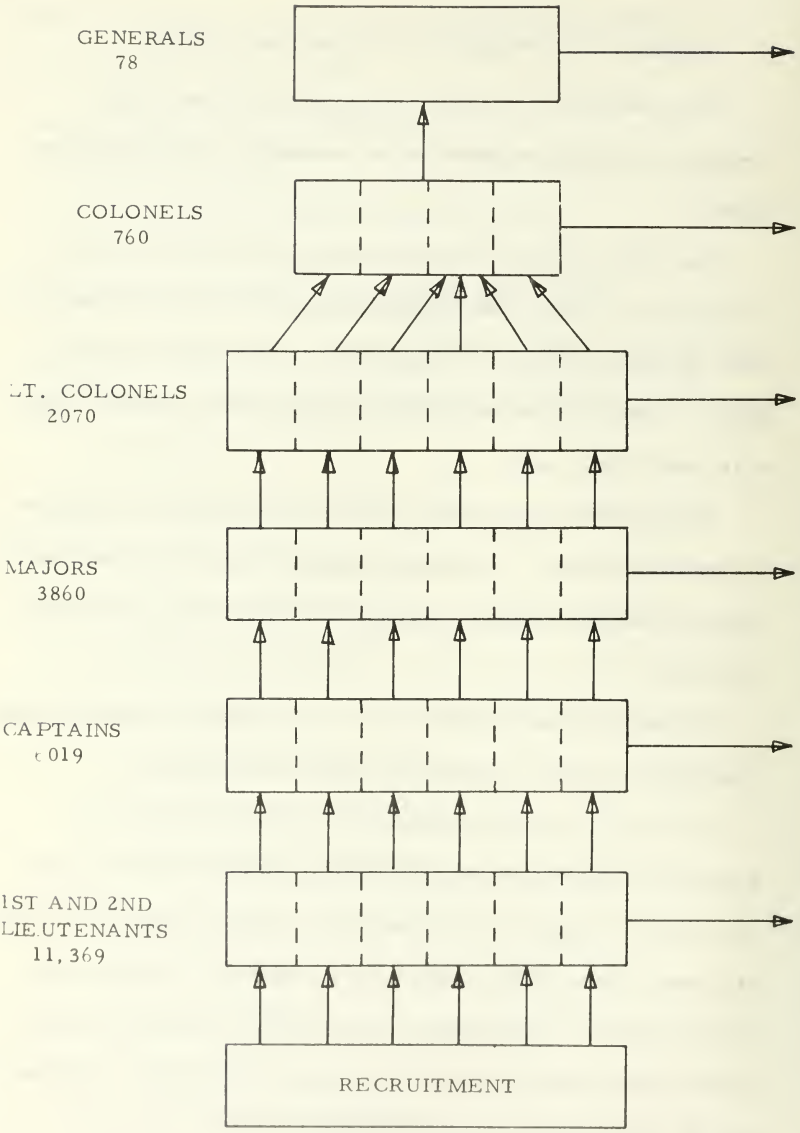

FIGURE I. MARINE CORPS OFFICER STRUCTURE AS OF 31 JULY 1969

III. MANAGING THE SYSTEM

Personnel management may be divided into four broad areas, which can be described as follows:

1. Determination of personnel requirements
2. Recruitment of personnel
3. Classification and assignment
4. Distribution of resources to meet requirements

This paper considers only steps 2 and 3 above. Consider a system that has been in operation a long time, and assume that the personnel presently in the system match the requirements of the system. Whenever a loss occurs it is necessary to recruit someone with the same qualifications as the person who left the system. This is not possible in the Marine Corps because most of the required skills are peculiar to Marine Corps; hence it becomes necesssary to promote someone from the next lower rank with the same skill (MOS) to fill the vacancy and a chain reaction occurs until it is necessary to bring a new officer into the system at the lowest rank.

Since the Marine Corps policy of promotion by seniority does not consider the MOS the officer has, it is possible that no promotion occurs in that MOS which is required and an imbalance occurs. That is, the required number of officers for a particular MOS are present in the system, but distributed across the ranks improperly.

This requires a personnel administrative decision to decide whether to retrain personnel or to temporarily employ at a higher or lower rank than is desired.

Returning to the area of recruitment, since a long lead-time is required for the recruiting process, it is necessary to predict the number of recruitments required and also the number required in each MOS. This can be represented in mathematical form by letting

$R(t)$ = a matrix whose elements $r_{ij}(t)$ represent the number of officers required for MOS i and rank j at time t

H = a matrix whose elements h_{ij} represent those officers present at time 0, who have MOS i and rank j

$L(t)$ = a matrix whose elements $l_{ij}(t)$ represent those officers who left the system during time interval 0 to t and had MOS i and rank j.

$N(t)$ = a matrix of input of officers during the interval $(0, t)$ necessary to meet requirement matrix $R(t)$.

then

$$H - L(t) + N(t) = R(t).$$

If we assume that R(0) = R(t) and that the system is in balance at time 0, that is H = R(0), then N(t) = L(t).

Considering that the Marine Corps generally recruits at the lowest rank, then

$$\sum_{i=1}^{\ell}\sum_{j=1}^{m} N_{ij}(t) = \text{Total recruitment}.$$

Let

$$\sum_{j=1}^{m} N_{ij} = \begin{pmatrix} N_1 \\ N_2 \\ \vdots \\ N_\ell \end{pmatrix}$$

which is a vector representation of the number of recruits required in each MOS.

The assumption that

$$H = R$$

is generally valid, since the Marine Corps with its primary, secondary, and tertiary MOS systems can easily shift resources to meet requirements.

If the dimensions of R(0) and R(t) are the same and if

$$\sum_{j=1}^{m}\sum_{i=1}^{\ell} R_{ij}(0) \quad \begin{matrix} \geq \\ (<) \end{matrix} \quad \sum_{j=1}^{m}\sum_{i=1}^{\ell} R_{ij}(t)$$

then recruitment is curtailed (stepped-up). However if the dimensions do not remain the same; that is, the deletion of an old MOS or the addition of a new MOS, then the problem becomes a retraining problem and not within the scope of this paper.

The above formulation is compatible with the Marine Corps personnel system. The Marine Corps presently uses the Manpower Management System (MMS) for maintaining personnel files. This system contains more than 100 separate items of information on each individual and can be used to determine the on-board strength matrix. The requirement matrix for the Marine Corps is known as the Grade Adjusted Recap (GAR). It is the summation of the requirements for all organizations in the Marine Corps and adjusted upward with allowances for personnel in training status, hospitalization, and transient.

All that is required are predictors for determining the loss matrix. These predictors may or may not be available.

IV. INTERPRETATION OF PAST DATA

In order to gain insight into the nature and scope of the problem it was necessary to collect past data and tabulate the data into useable form.

Ten years of data was provided by Headquarters United States Marine Corps and the data was tabulated to determine percent of losses per year, losses by rank per year, and losses by reason per year.

Table 1 shows the percentage of losses per fiscal year with respect to total size of the officer Corps.

Fiscal Year	Total Officers	Officer Losses	Percent Loss
1960	16,079	2,221	13.81
1961	16,215	2,464	15.20
1962	16,162	2,255	13.95
1963	16,885	2,769	16.40
1964	16,762	2,775	16.56
1965	16,843	2,634	15.64
1966	17,258	1,876	10.87
1967	20,512	2,861	13.95
1968	23,592	3,434	14.55
1969	24,555	3,217	13.10

TABLE 1: PERCENTAGE OF OFFICER LOSSES BY FISCAL YEAR

Fiscal year 1966 was the first year of involuntary retention for certain occupational fields. Eliminating fiscal year 1966 for the above reason, the data has a mean percent loss of 14.80 and a standard deviation of 1.22 percent. This indicates that the overall loss rates are quite stationary over time.

It was necessary to determine where the losses were occurring in the system and what were the reasons for these losses. This was necessary in order to determine an approach to the problem. Table II shows the broad categories of losses and ranks at which the losses occurred. The data is for a 10 year period (fiscal years 1960 through 1969).

	RANK						
Categories	Col	Lt Col	Maj	Capt	1st Lt	2nd Lt	Total
Released	8	42	160	3130	7169	18	10,527
Retired	851	1360	1571	804	209	56	4,851
Resigned	0	2	152	1537	1097	280	3,104
Died	21	45	111	277	355	324	1,133
Discharged	0	1	19	272	133	180	605
Reverted	0	0	0	16	161	10	187
Total	880	1450	2013	6072	9124	868	20,407

TABLE II. OFFICER LOSSES BY CATEGORY AND RANK

From Table II it is seen that over 50 percent of losses from the system result from those officers who were released from active duty. Each Reserve Officer has an end of active duty date, and unless he requests and is accepted as a Regular Officer he is released from active duty on that date. Hence, one-half the problem of determining the total losses in a given time period is deterministic.

A further look at Table II indicates that approximately 45 percent of the losses occur due to retirements, resignations and deaths. This shows the major areas where predictions are necessary. The table also shows at what ranks, within each category, the losses have occurred. A more detailed breakdown of the data is available in Appendix B.

It now becomes necessary to determine the nature of the predictors. Harding [Ref (2)] suggests that the probability of remaining in the system is a function of the length of service. For instance, the probability of remaining in the system if an officer has 18 years of service might be 1; while the probability of remaining in the system of an officer with 5 years of service might be .3. Other pertinent indicators are rank and occupational field. In other words, if two officers have 22 years of service but one has the rank of Major while the other has the rank of Colonel, then each would have a different probability of leaving the system.

The literature also suggests that such things as source of entrance to system, the amount of education, and the section of

the country that the individual was from are indicators of whether an individual will remain in the system or depart from the system [Ref (7)]. The Marine Corps attrition is approximately 2,000 per year of which 50 percent leave the system because they are released to inactive duty; this leaves 1,000 for which predictions have to be made. Dividing this data into very many categories will lead to difficulties in obtaining predictors because a change of one individual in a category may significantly change the predictor. In other words, there is a limit on the number of categories that the data can be subdivided. In fact, dividing the data into ranks, MOS and years of service may not be feasible. If not, MOS's can be grouped or years may be grouped.

Considering the above information the following model is developed.

V. DESCRIPTION OF THE MODEL

Recalling from section II that there are three basic ways of leaving the system. They are:

1. Uncontrollable
    a. Natural death
    b. War Casualty
        (1) Death
        (2) Physical Disability
2. Marine Corps Decisions
    a. Disciplinary
    b. Promotion failure
    c. Released from active duty
    d. Revert to enlisted status
3. Individual Officers Decision
    a. Retirement
    b. Resignation

For the purposes of this project the data in the last section has war deaths and natural deaths summed together, the category discharged include physical disability, disciplinary and promotion failure (if length of service was under 20 years). Retirements include those officers who twice failed promotion (if length of service was 26 years for Lieutenant Colonel and 30 years for Colonels).

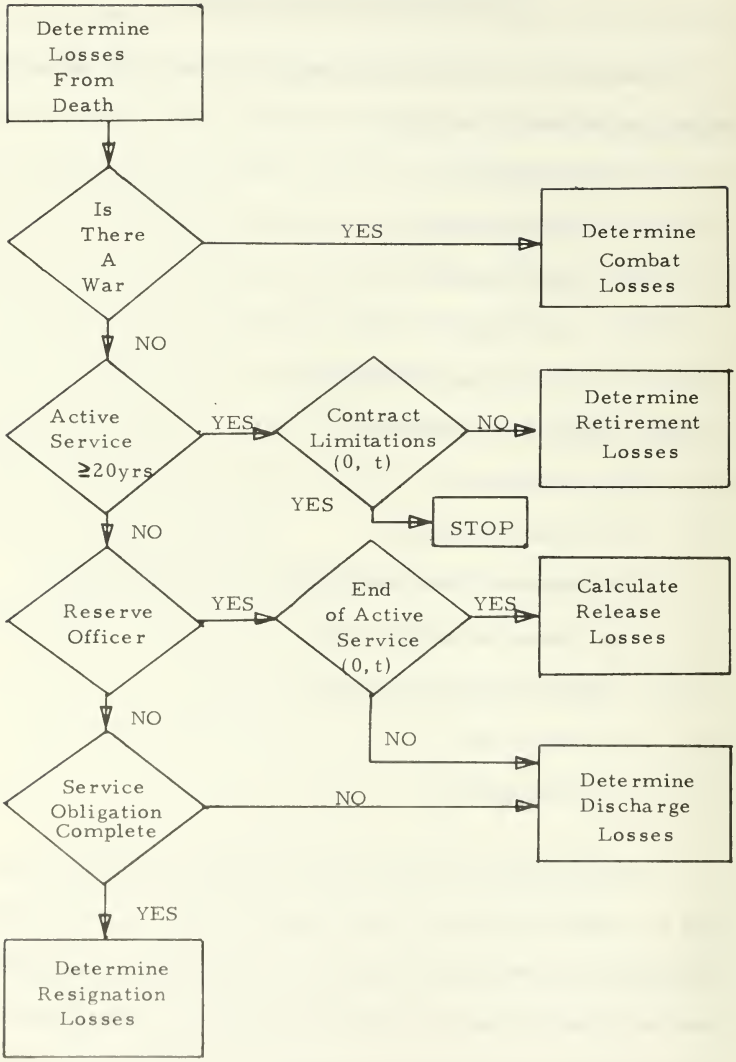

FIGURE II. PREDICTION MODEL FLOW CHART

The model is best described by a flow chart shown in figure II. Each block is discussed separately below.

A. DETERMINATION OF LOSSES THROUGH DEATH

Since death affects all individuals and it is an uncontrollable factor, it is considered first. The determination of losses from natural death can be accomplished in the following manner. For the purpose of this paper the time increment from 0 to t is considered to be one year.

Let: M = a matrix whose m_{ij} element represents those officers whose age is i and who have MOS j.

d = a row vector whose elements d_i represent the probability of death of an individual of age i.

then $dM = n$

which is a column vector whose elements n_j represent the number of expected natural deaths in MOS j.

B. DETERMINATION OF COMBAT LOSSES

Combat losses are a function of the number exposed to combat by rank and MOS. These losses can be predicted as follows:

Let: E = a matrix whose elements e_{ij} represent the number of officers of rank i and MOS j expected to be exposed to combat during the next time increment.

C = a matrix whose elements c_{kl} represent conditional probabilities of becoming a casualty of those officers with MOS k and rank l, given they are exposed to combat. Each matrix is determined from past data.

then $CE = B$

where b_{jj}, the diagonal elements of B represent the losses in MOS j due to battle casualties.

Each of the losses would be subtracted from the on-hand matrix as they are determined.

C. RETIREMENT LOSSES

First determine whether the officer has 20 years of active service, and hasn't any obligations for various reasons, such as, obligations for advanced schooling, obligations of 2 years of required service upon the acceptance of the rank of Lieutenant Colonel or Colonel, etc. These data are avilable from the manpower management system and are computerized. Then the retirement losses can be determined by letting

F(k) = a matrix whose elements $f_{ij}(k)$ represents all officers of rank k eligible to retire, where i is the number of years of service and j is the MOS.

G(k) = a matrix of probabilities of retirement where element $g_{mm}(k)$ is the probability an officer of

rank k with MOS n and years service equal to m,

leaves the system.

then, $G(k)F(k) = S(k)$

and $s_{jj}(k)$, the diagonal elements, represent the number of retirement losses from rank k and MOS j. As we have noted we require an F and G for each rank, since each rank has different probabilities of retirement for a given length of service.

D. LOSSES FROM RELEASES FROM ACTIVE DUTY

These losses can be determined directly from the Marine Corps manpower management system by addressing the computer for all reserves whose expiration of active service occurs during the time interval selected.

Let: T = a matrix whose elements t_{jk} represent those officers released from active with MOS j and rank k.

E. DETERMINATION OF RESIGNATIONS

First determine all regular officers whose obligated service has been fulfilled. Then by letting

V(k) = matrix of above officers of rank k with elements $v_{ij}(k)$, i = years service, j = MOS.

P(k) = matrix with elements $p_{ji}(k)$ which represents the probability of a regular officer of rank k with MOS j and years of service i, resigning.

then $P(k)V(k) = Q(k)$

and $q_{jj}(k)$ will be the number of officers of rank k possessing MOS j, resigning.

F. DISCHARGE LOSSES

As seen from the flow diagram, discharges occur at two places; regular officers whose expiration of active service does not expire during the chosen interval.

Let: $W(k)$ = matrix of officers of rank k whose initial obligation does not expire in the given time increment. The elements $w_{ij}(k)$ represent an officer with i years of service and MOS j.

$Y(k)$ = matrix of probabilities where $y_{ji}(k)$ represent probability of being discharged with i years of service and MOS j.

then $W(k)Y(k) = X(k)$

where $x_{jj}(k)$ represents the number of losses due to discharge.

G. TOTAL LOSSES

Determination of total losses is the summation of losses for all reasons.

Let: l = a row vector whose elements l_j represent total losses in MOS j.

then

$$l_j = n_j + b_{jj} + \sum_{k=1}^{M} \mathcal{L}_{jj}(k) + \sum_{k=1}^{M} t_{jk} + \sum_{k=1}^{M} q_{jj}(k) + \sum_{k=1}^{M} \mathcal{K}_{jj}(k) \quad ,$$

where k represents each rank. The total losses would be the summation of l for j equal to all MOS's.

H. MODEL REFINEMENT FOR PERSONNEL BUDGET FORECASTING

It is necessary for sound fiscal policy to be able to predict personnel budget figures in advance. Since pay is based on rank and years of service for pay purposes, this only requires the above model to combine all MOS's and determine probabilities of exit from the system by years of service for pay purposes rather than years of active service. In addition to determining losses by rank and years for pay, it would be necessary to determine accessions by rank and pay year. This would entail a promotion prediction model, which is in existence at Headquarters United States Marine Corps [Ref (7)].

I. USE OF THE MODEL FOR PROMOTION PREDICTION

As shown in section II, the number of Lieutenant Colonels who can be promoted to Colonel, provided the ceiling on the number of Colonels remains the same, is the total of the number of Colonel

promotions plus the number of Colonels who departed the system. It is only necessary to sum up those Colonels over each MOS to obtain the number of Colonels leaving the system. Hence, the model can be modified to determine the number of required promotion to each rank.

VI. CALCULATING THE PREDICTORS

In order to determine the predictors it would be necessary to look at past data and determine the rank, MOS, years of service, and reason for leaving the system. This data was not available. However, manual calculations were made from The Combined Lineal List of Officers on Active Duty in the Marine Corps, "The Blue Book," in order to show the nature of these predictors [Ref (6)].

A. DETERMINATION OF RETIREMENT PROBABILITIES FOR COLONEL AND LIEUTENANT COLONEL

Section IV shows that virtually all attritions for Colonel and Lieutenant Colonel were due to retirement. Hence, it was decided that if two consecutive "Blue Books" were considered and if a Colonel's name appeared in the first "Blue Book" and not in the second "Blue Book", then he left the system through retirement. All Colonels who were promoted to Brigadier Generals were so marked and were not considered in the calculations. All Colonels not having two years in grade were not considered, because they are required to serve two years upon acceptance or promotion before requesting retirement. All Colonels who left were marked and their years of service for pay purposes were recorded. Then all Colonels eligible to retire, were considered and their years of

service for pay purposes were recorded. A ratio was established between the number present and the number who left for a given year. Ten consecutive "Blue Books" were considered, years 1960 through 1969, giving 9 comparisons. This procedure required over 9,000 manual calculations.

The same procedure was used for Lieutenant Colonels, except only 5 comparisons were made. This required approximately 10,800 calculations.

Appendix C contains amplifying data; the summarized results are presented in Table III.

Years Service For Pay	Mean Probability of Retirement Colonels	Standard Deviation	Mean Probability of Retirement Lt. Colonels	Standard Deviation
20, 21	.031	.027	.106	.057
22, 23	.055	.031	.111	.045
24, 25	.056	.016	.151	.051
26, 27	.271	.065	.256	.085
28, 29	.308	.106	.218	.118
30, 31	.474	.105	.620	.144
32-36	.316	.115	.394	.073
37	1.000	.000	1.000	.000

TABLE III. RETIREMENT PROBABILITIES

B. DETERMINATION OF RESIGNATION RATES

The following data was obtained from [Ref. (3)], and represents data obtained from the "Blue Book" with regards to the number of regular officers who left the Marine Corps after a given length of service.

A given set of regular officers was traced through 11 consecutive "Blue Books" and the fraction of those who left were recorded. Table IV gives the year the officers started and fractions leaving.

Years of Service	STARTING YEAR 1956	1957	1958	Mean Probability of Leaving
1	0/414	0/339	0/369	.000
2	4/414	2/339	2/369	.007
3	2/410	3/337	5/369	.009
4	152/408	116/334	105/362	.338
5	50/256	28/218	46/257	.170
6	24/206	22/190	15/211	.100
7	6/182	12/168	9/196	.050
8	5/176	6/156	7/187	.035
9	3/171	6/150	10/178	.038
10	3/168	3/144	9/168	.031
11	9/165	8/141	20/157	.079

TABLE IV. RESIGNATION RATES VS. YEARS OF SERVICE

Although the data above may contain some officers who left by reasons other than resignation, it was included to show the nature of the numbers that are required to obtain predictors for resignations by years of service.

C. SOME CALCULATIONS

A small section of a Marine Corps Personnel data tape was made available by Marine Corps Data Section, Kansas City, Missouri [Ref. (8)]. The following matrices were obtained from the tape. Table V gives the number of Colonels eligible to retire by MOS. That is, those Colonels who have at least 20 years of active service and 2 years in rank. Table VI shows the number of Colonels by age and MOS and is used to determine the number of deaths.

	MOS			
Years Service for Pay	9906	9907	9908	4409
20-21	0	0	0	0
22-23	2	0	0	0
24-25	12	2	0	1
26-27	239	192	22	10
28-29	68	43	7	2
30-31	16	3	1	0
32-36	1	4	0	0
37	1	0	0	0

TABLE V. COLONELS ELIGIBLE TO RETIRE

	MOS			
Age	9906	9907	9908	4409
41	1	1	0	0
42	5	0	0	0
43	13	8	0	1
44	32	8	3	1
45	24	23	2	0
46	52	40	6	1
47	58	48	4	3
48	70	57	12	4
49	50	40	3	2
50	38	12	1	2
51	31	15	2	1
52	12	7	3	0
53	8	2	0	0
54	1	1	1	0
55	4	0	1	1
56	0	0	0	0
57	2	0	0	0
58	1	0	0	0
	402	262	38	15

TABLE VI. MATRIX OF COLONELS BY AGE AND MOS

Assuming that retirement of Colonels is independent of MOS and letting

F = the matrix of Colonels eligible to retire as shown above

G = a matrix of probabilities of retirement with each row equivalent to those probabilities given in this section

then

GH = J,

and j, the diagonal elements, represent the predicted number of retirements of Colonels in the time increment of one year. Completing this multiplication the predicted retirements for 1970 are

	MOS				
	9906	9907	9908	4409	Total
Predicted retirements	98	68	8	3	177

Using the standard deviation given in Table III and normal probability tables; the 80 percent confidence limits are given in Table VII.

	MOS				
	9906	9907	9908	4409	Total
Lower Limit	62	45	6	3	116
Mean	98	68	8	3	177
Upper Limit	134	91	10	3	234

TABLE VII. EIGHTY PERCENT CONFIDENCE LIMITS

Using a similar multiplication for predicting losses of Colonels through death, where

M = the matrix of Colonels by age and MOS given above

d = a vector of probabilities taken from a standard mortality table

then

$$dM = n$$

Completing this multiplication the following results show the number of predicted deaths.

	MOS				
	9906	9907	9908	4409	Total
Predicted Deaths	2	1	0	0	3

Hence, the total losses of Colonels from the Marine Corps in 1970 would be 180; this compares with the losses for fiscal year 1969 when the losses were 151.

The number of promotions available to Lieutenant Colonels for promotion to Colonel would be 180 plus the number of Generals who left the Marine Corps.

VII. ESTIMATE OF DATA REQUIREMENTS

As seen from the previous section it requires a great number of data points in order to determine the probabilities of losses through retirement. It would require approximately 270,000 data points to determine 10 years of predictors for retirement and resignation rates. In addition, it would require approximately 30,000 data points to determine casualty rates for a 6 year period.

The amount of man hours of work required will depend upon the nature of the data. If it is on computer tape, then the work load will greatly reduce. However, if the data collection would require manual extraction of data from historical files, then it would require about 10 man months for data collection.

Once the different probabilities are determined the model is easily amenable to computer simulation using current Marine Corps personnel data tapes.

VIII. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The problem we started out to solve was that of predicting losses in the United States Marine Corps officer structure by military occupational specialty. We first described the need for such a prediction model. Then the Marine Corps officer structure was discussed. The problem was analyzed by considering past data to determine where the losses were occurring. The model was used in predicting losses for Colonels.

Although only limited results were available from this model because of the inaccessibility of the data, it is recommended that this model be pursued further since it can be used in a number of different predictions.

One major question remains unanswered: that is, will the information provided from this model be worth the time and effort which will be required to collect the data in the required format. This question can only be answered by making a test evaluation.

APPENDIX A

CATEGORIES

I	Limited to assignment as primary MOS for regular unrestricted officers and career reserve officers.
II	Limited to assignment as primary MOS for limited duty officers only.
III	Limited to assignment as primary MOS for "Marine Gunners" who were appointed in FY'65 or later.
IV	Limited to assignment as primary MOS for Warrant Officers only.
BLANK	May be assigned as an additional MOS to any qualified male officer. May also be assigned as a primary or an additional MOS to other Commissioned Reserve Officers, temporary officers and Commissioned Women Officers.

REFERENCE MOS Manual
Marine Corps Order P1200-7A
Revised date, 1 Nov 1969

MOS	JOB	CATEGORY
01	Personnel and Administration	
0102	Personnel Officer	
0107	Civil Affairs Officer	
0108	Psychological Operations Officer	
0130	Administrative Officer	II, IV
0140	Investigations Officer	IV
0160	Postal Officer	II, IV
02	Intelligence	
0202	Intelligence Officer	II, IV
0210	Counter Intelligence Officer	II, IV
0240	Imagery Interpretation Officer	II, IV
0250	Interrogation-Translation Officer	II, IV
03	Infantry	
0302	Infantry Officer	I, III
04	Logistics	
0402	Logistics Officer	II
0406	Combat Support Officer	
0430	Embarkation Officer	II
08	Field Artillery	
0802	Field Artillery Officer	I, III
0803	Survey and Meterological Officer	IV
0805	Air Observer	III
0840	Naval Gunfire Planner	
0845	Naval Gunfire Spotter	
13	Engineer and Shore Party	
1302	Engineer Officer	I
1310	Engineer Equipment Officer	II, IV
1320	Utilities Officer	IV
1330	Facilities Maintenance Engineer Officer	
1360	Construction Officer	IV
1390	Bulk Fuel Officer	IV
14	Mapping	
1402	Mapping Officer	IV
15	Printing and Reproduction	
1502	Reproduction Officer	IV

MOS	JOB	CATEGORY
18	Tank and Amphibian Tractor	
1802	Tank Officer	I, III
1803	Armored Amphibian and Amphibian Tractor Officer	I, III
20	Ordnance	
2002	Ordnance Officer	II, IV
2010	Tracked Vehicle Maintenance	II, IV
2020	Weapons Repair Officer	II, IV
2025	Instrument Repair Officer	IV
2040	Ammunition Officer	II, IV
2045	Explosive Ordnance Disposal Officer	II, IV
2070	Weapons System Engineer	
25	Operational Communications	
2502	Communications Officer	I, III
2510	Signals Intelligence/Electronic Warfare Officer	II
2515	Cryptologic Electronic Warfare Officer	IV
28	Telecommunications Maintenance	
2803	Communications Engineer	
2805	Telecommunications Maintenance Officer	II, IV
2810	Telephone Systems Maintenance Officer	IV
30	Supply Administration and Operations	
3002	Supply Officer	I
3010	Supply Operations Officer	II, IV
3040	Contracting Officer	II
3050	Warehousing Officer	II, IV
3060	Aviation Supply Officer	II, IV
31	Transportation	
3102	Traffic Management Officer	II, IV
32	Supply Service	
3202	Supply Service Officer	IV
33	Food Service	
3302	Food Service Officer	II, IV
3310	Bakery Officer	IV
34	Auditing, Finance, and Accounting	
3402	Disbursing Officer	II, IV
3406	Financial Accounting Officer	II, IV
3410	Auditing Officer	II, IV

MOS	JOB	CATEGORY
35	Motor Transport	
3502	Motor Transport Officer	I, III
3510	Motor Transport Maintenance Officer	II, IV
40	Data Systems	
4002	Data Systems Automation Officer	I
4003	Systems Analyst Officer	
4005	Systems Development Officer	
4006	Data Automation Operations Officer	II, IV
4010	Digital Computer Systems Software Officer	II, IV
41	Marine Corps Exchange	
4130	Marine Corps Exchange Officer	II, IV
43	Public Affairs	
4302	Public Affairs Officer	II, IV
4330	Historical Officer	
44	Legal	
4402	Judge Advocate	I
4420	Special Courts-Martial Legal Officer	
46	Photography	
4602	Photographic Officer	II, IV
49	Training and Training Aids	
4902	Training Aids Officer	
4915	Range Officer	III
55	Band	
5502	Band Officer	IV
57	Nuclear, Biological and Chemical	
5702	Nuclear, Biological and Chemical Defense Officer	IV
5710	Nuclear, Biological and Chemical Weapons Section Officer	
5720	Ground Nuclear Weapons Assembly Officer	
58	Corrections	
5802	Corrections Officer	IV
59	Electronic Maintenance	
5903	Electronics Engineer	
5905	Electronics Officer	II
5907	Ground Launch Missile Systems Maintenance Officer	II, IV

MOS	JOB	CATEGORY
5910	Radar Officer	II, IV
5920	Calibration Officer	
5950	Air Traffic Control System Maintenance Officer	II, IV
5970	Data Systems Maintenance Officer	II, IV
60	Aircraft Maintenance	
6002	Aircraft Maintenance Officer	II, IV
6005	Aeronautical Engineer	
6007	Flight Equipment Officer	IV
6009	Aircraft Maintenance Ground Support Equipment	
62	Avionics	
6202	Avionics Officer	II, IV
6204	Avionics Guided Missile Maintenance Officer	
65	Aviation Ordnance	
6502	Aviation Ordnance Officer	II, IV
67	Air Control/Anti-Air Warfare	
6702	Air Control/Anti-Air Warfare Officer	I
6703	Guided Missile Systems Officer	
6704	Anti-Air Warfare Officer	I, III
6706	Tactical Data Systems Computer Programming Officer	
6707	Forward Air Controller	
6708	Air Support Control Officer	I, III
6709	Air Defense Control Officer	I, III
6710	Air Defense Control Officer, Automated System	I, III
6720	Air Traffic Control Officer	I, III
68	Aerology	
6802	Aerology Officer	IV
70	Aviation Operations	
7002	Airfield Operations Officer	IV
71	Air Delivery	
7140	Air Delivery Officer	
75	Pilots/Naval Flight Officers	
7500	Basic Pilot VMA	I
7501	A-4 Pilot	I
7510	Basic Pilot VMA (AW)	I
7511	A-6 Pilot	I
7520	Basic Pilot VMFA	I

MOS	JOB	CATEGORY
7521	F-4B Pilot	I
7522	F-4J Pilot	I
7530	Basic Pilot VMF/VMF (AW)	I
7531	F-8/A/B/C Pilot	I
7532	F-8/D/E Pilot	I
7540	Basic Pilot VMCT	I
7541	EF-10B Pilot	I
7542	EA-6A Pilot	I
7543	Ea-6B Pilot	I
7544	RF-8A Pilot	I
7545	RF-4B Pilot	I
7550	Basic Pilot VMR/VMGR	I
7551	C-47 Pilot	I
7552	C-54 Pilot	I
7553	C-117 Pilot	I
7554	C-118 Pilot	I
7555	C-119 Pilot	I
7556	C-130 Pilot	I
7557	KC-130 Pilot	I
7558	C-131 Pilot	I
7560	Basic Pilot HMH/M/L/LA	I
7561	VH-34 Pilot	I
7562	Ch-46 Pilot	I
7563	VH-1 Pilot	I
7564	CH-53 Pilot	I
7565	AH-1 Pilot	I
7575	Basic Pilot VMO	I
7576	OV-10A Pilot	I
7580	Flight Officer Student	I
7581	Basic Naval Flight Officer	I
7582	Airborne Radar Intercept Officer F-4B	I, III
7583	Bombardier/Navigator	I, III
7584	Airborne Electronics Countermeasures Officer	I, III
7585	Airborne Reconnaissance Officer	I, III
7586	Airborne Electronics Countermeasures/ Reconnaissance Officer	I, III
7587	Airborne Radar Intercept Officer F-4J	I, III
7588	Airborne Navigator	I, III
7597	Basic Rotary Wing Pilot	I
7598	Basic Fixed Wing Pilot	I
7599	Flight Student	I
99	Identifying and Reporting Codes	
9901	Basic Officer	I
9903	General Officer	I

MOS	JOB	CATEGORY
9906	Colonel, Ground	I
9907	Colonel, Naval Aviator	I
9908	Colonel, Supply	I
9909	Colonel, Data Systems	I
9910	Billet Designator--Unrestricted Officer	
9911	Billet Designator--Unrestricted Ground Officer	
9912	Billet Designator Naval Aviator/Naval Flight Officer	
9914	Colonel, Judge Advocate	
9920	Women's Unit Officer	
9925	Selective Service Officer	
9930	Defense Systems Analyst	
9935	Military Operations Analyst	
9952	Scuba Officer	
9953	Parachutist/Scuba Officer	
9962	Officer Parachutist Officer	

APPENDIX B

FISCAL YEAR 1960

RANK

	06	05	04	03	02	01	TOTAL
RESIGN	0	1	6	62	184	43	296
DISCHARGE	0	0	0	8	13	16	37
RELEASE	0	7	25	99	995	3	1129
RETIRE	61	53	60	76	16	3	269
REVERT	0	0	0	0	0	0	0
DEATH	0	6	8	8	17	9	48
TOTAL	61	67	99	253	1225	74	1779

FISCAL YEAR 1961

RANK

	06	05	04	03	02	01	TOTAL
RESIGN	0	0	4	45	191	28	268
DISCHARGE	0	0	2	9	34	15	60
RELEASE	1	6	22	96	1114	0	1239
RETIRE	72	99	74	129	12	2	388
REVERT	0	0	0	2	1	0	3
DEATH	2	2	10	20	16	3	53
TOTAL	75	107	112	301	1368	48	2011

OFFICER ATTRITION

FISCAL YEAR 1962

RANK

	06	05	04	03	02	01	TOTAL
RESIGN	0	1	4	51	188	22	266
DISCHARGE	0	0	3	40	15	19	77
RELEASE	1	5	14	70	880	3	973
RETIRE	52	160	84	198	13	4	511
REVERT	0	0	0	2	0	0	2
DEATH	1	1	6	14	17	7	46
TOTAL	54	167	111	375	1113	55	1875

FISCAL YEAR 1963

RANK

	06	05	04	03	02	01	TOTAL
RESIGN	0	0	4	64	194	32	294
DISCHARGE	0	0	0	10	15	31	56
RELEASE	0	6	19	87	1040	2	1154
RETIRE	91	210	305	169	13	3	791
REVERT	0	0	0	1	0	0	1
DEATH	3	3	3	9	15	9	41
TOTAL	94	219	331	340	1277	76	2337

FISCAL YEAR 1964

RANK

	06	05	04	03	02	01	TOTAL
RESIGN	0	0	3	50	125	15	193
DISCHARGE	0	0	1	18	18	10	47
RELEASE	2	2	5	39	728	2	778
RETIRE	73	171	377	28	10	3	662
REVERT	0	0	0	0	0	0	0
DEATH	0	4	9	15	20	7	55
TOTAL	75	177	395	150	901	37	1735

FISCAL YEAR 1965

RANK

	06	05	04	03	02	01	TOTAL
RESIGN	0	0	7	69	99	16	191
DISCHARGE	0	0	0	26	5	13	44
RELEASE	0	1	0	44	1021	0	1066
RETIRE	76	113	126	26	7	0	348
REVERT	0	0	0	2	0	0	2
DEATH	1	3	2	16	19	5	46
TOTAL	77	117	135	183	1151	34	1697

OFFICER ATTRITION

FISCAL YEAR 1966

RANK

	06	05	04	03	02	01	TOTAL
RESIGN	0	0	3	70	58	15	146
DISCHARGE	0	0	1	16	5	9	31
RELEASE	0	0	4	112	906	1	1023
RETIRE	44	68	101	26	15	1	255
REVERT	0	0	0	0	0	0	0
DEATH	1	4	8	20	32	16	81
TOTAL	45	72	117	244	1016	42	1536

FISCAL YEAR 1967

RANK

	06	05	04	03	02	01	TOTAL
RESIGN	0	0	15	468	26	30	539
DISCHARGE	0	0	0	30	8	17	55
RELEASE	1	0	7	596	320	1	925
RETIRE	89	161	162	31	21	22	486
REVERT	0	0	0	1	0	3	4
DEATH	4	3	15	47	40	71	180
TOTAL	94	164	199	1173	415	144	2189

OFFICER ATTRITION

FISCAL YEAR 1968

RANK

	06	05	04	03	02	01	TOTAL
RESIGN	0	1	40	354	14	39	448
DISCHARGE	0	0	1	52	10	22	85
RELEASE	1	5	25	973	57	3	1064
RETIRE	153	141	147	49	38	10	538
REVERT	0	0	0	1	55	4	60
DEATH	6	11	36	79	86	121	339
TOTAL	160	158	249	1508	260	199	2534

FISCAL YEAR 1969

RANK

	06	05	04	03	02	01	TOTAL
RESIGN	0	0	66	340	18	40	464
DISCHARGE	0	1	11	63	10	28	113
RELEASE	2	9	39	1014	108	3	1175
RETIRE	140	184	135	72	64	8	603
REVERT	0	0	0	7	105	3	115
DEATH	3	8	14	49	93	77	244
TOTAL	145	202	265	1545	398	159	2714

OFFICER ATTRITION

RANK

	06	05	04	03	02	01	TOTAL
RESIGN	0	2	152	1573	1097	280	3104
DISCHARGE	0	1	19	272	133	180	605
RELEASE	8	42	160	3130	7169	18	10527
RETIRE	851	1360	1571	804	209	56	4851
REVERT	0	0	0	16	161	10	187
DEATH	21	45	111	277	355	324	1133
TOTAL	880	1450	2013	6072	9124	868	20407

OFFICER ATTRITION

FISCAL YEARS 1960 THROUGH 1969

RANK/FY	60	61	62	63	64	65	66	67	68	69	TOTAL
COLONEL	61	75	54	94	75	77	45	94	160	145	880
LT/COL	67	107	167	219	177	117	72	164	158	202	1450
MAJOR	99	112	111	331	395	135	117	199	249	265	2013
CAPTAIN	253	301	375	340	150	183	244	1173	1508	1545	6072
1ST/LT	1225	1368	1113	1277	901	1151	1016	415	260	398	9124
2ND/LT	74	48	55	76	37	34	42	144	199	159	868
TOTAL	1779	2011	1875	2337	1735	1697	1536	2189	2534	2714	20407

ATTRITION BY EACH RANK

REASON/FY	60	61	62	63	64	65	66	67	68	69	TOTAL
RESIGN	296	268	266	294	193	191	146	539	448	464	3104
DISCHARGE	37	60	77	56	47	44	31	55	85	113	605
RELEASE	1129	1239	973	1154	778	1066	1023	925	1064	1175	10527
RETIRE	269	388	511	791	662	348	255	486	538	603	4851
REVERT	0	3	2	1	0	2	0	4	60	115	187
DEATH	48	53	46	41	55	46	81	180	339	244	1133
TOTAL	1779	2011	1875	2337	1735	1697	1536	2189	2534	2714	20407

ATTRITION ALL RANKS

	TOTAL			COLONEL			LT COL			MAJOR		
FY	TOTAL	ATT	%	TOT	ATT	%	TOT	ATT	%	TOT	ATT	%
69	24555	3217	13.10	750	151	20.10	2011	202	10.04	3823	277	7.25
68	23592	3434	14.55	738	160	21.68	1538	158	10.27	3589	357	9.95
67	20512	2861	13.95	710	94	13.24	1452	164	11.29	2891	214	7.40
66	17258	1876	10.87	593	45	7.59	1408	72	5.11	2498	117	4.68
65	16843	2634	15.64	606	77	12.71	1402	117	8.35	2434	135	5.55
64	16762	2775	16.56	574	76	13.24	1362	181	13.30	2371	395	16.66
63	16885	2769	16.40	602	94	15.61	1416	219	15.47	2357	334	14.17
62	16162	2255	13.95	610	54	8.85	1418	167	11.78	2232	112	5.02
61	16215	2464	15.20	601	75	12.48	1356	107	7.89	2380	116	4.87
60	16079	2221	13.81	546	61	11.17	1349	67	4.97	2570	99	3.85

PERCENT OFFICER ATTRITION BY RANK

	CAPTAIN			1ST LT.			2ND LT.		
FY	TOT	ATT	%	TOT	ATT	%	TOT	ATT	%
69	5687	1625	28.57	6701	499	7.45	4063	253	6.23
68	5946	1867	31.40	2953	446	15.10	7223	248	3.43
67	4736	1316	27.79	3890	680	17.48	5456	292	5.35
66	4034	268	6.64	4827	1221	25.30	2253	104	4.61
65	3766	387	10.78	4939	1587	32.13	2102	158	7.52
64	3998	407	10.18	4189	1437	34.30	2752	179	6.50
63	4263	370	8.70	4116	1422	34.55	2833	244	8.61
62	4266	391	9.17	4207	1279	30.40	2391	167	6.98
61	4563	348	7.63	3808	1568	41.18	2568	127	4.95
60	4299	269	6.28	3466	1267	36.56	3083	129	4.18

PERCENT OFFICER ATTRITION BY RANK

APPENDIX C

TABLE GIVES THE NUMBER WHO LEFT IN THE
NUMERATOR AND NUMBER PRESENT IN THE DENOMINATOR

Years of Service

YEAR	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1960	3/56	2/55	1/42	0/46	4/79	8/70	6/23	5/22	6/17	5/10	8/10	3/6	3/4	0/4	0/0	1/2	0/2
1961	4/60	3/103	3/59	1/36	0/54	7/71	8/60	6/16	8/17	4/11	5/5	1/4	1/8	0/2	1/4	0/0	0/1
1962	0/2	0/112	1/97	3/64	2/37	1/54	16/71	14/50	0/11	2/8	4/7	1/2	0/2	0/1	0/2	0/2	0/0
1963	0/0	0/2	13/106	5/88	3/58	2/32	17/52	12/48	11/34	2/10	4/6	1/4	0/1	0/1	0/1	0/2	1/3
1964	0/0	0/1	0/3	15/205	10/102	3/57	10/33	7/35	8/40	6/22	5/8	0/2	2/2	1/1	1/1	1/1	1/2
1965	0/0	0/0	0/1	1/31	9/218	4/90	27/56	6/22	10/30	12/35	8/17	0/2	1/2	0/0	0/0	0/0	0/0
1966	0/0	0/0	0/0	0/1	4/67	11/231	20/86	9/34	4/25	6/21	8/26	6/10	0/2	0/1	0/1	0/0	0/0
1967	0/0	0/0	0/0	0/0	0/10	11/180	60/224	27/82	13/30	8/23	7/17	8/20	2/4	0/1	1/1	0/1	0/0
1968	0/0	0/0	0/0	0/0	0/1	1/14	44/267	69/160	17/61	9/21	9/17	5/12	5/11	2/2	1/2	0/0	0/2
TOT	7/118	5/273	18/308	25/471	31/630	48/817	208/901	155/485	77/267	54/164	58/113	25/63	14/37	3/13	4/12	2/8	2/9

COLONEL ATTRITION BY CALENDAR YEAR

TABLE GIVES THE NUMBER WHO LEFT IN THE
NUMERATOR AND NUMBER PRESENT IN THE DENOMINATOR

	Years of Service																
YEAR	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1964	0/9	7/46	72/680	57/144	14/82	5/24	4/31	4/15	4/17	3/9	5/10	3/4	1/2	1/1	1/2	0/0	0/1
1965	0/2	0/15	2/77	33/624	18/80	9/59	3/19	8/25	0/11	0/13	5/6	2/7	0/1	0/1	0/0	1/1	0/0
1966	1/13	3/19	3/45	18/162	84/577	20/75	7/56	2/13	5/15	2/12	10/14	1/3	0/3	1/2	0/0	1/1	0/0
1967	5/29	5/44	10/53	9/67	9/163	47/402	12/59	10/49	1/15	6/19	5/11	1/3	0/2	2/5	1/1	0/0	0/0
1968	4/80	8/55	10/77	9/85	17/78	30/135	78/241	14/47	15/42	1/17	13/15	4/6	1/3	0/2	2/3	0/0	0/0

LT. COLONEL ATTRITION BY CALENDAR YEAR

YEAR	20-21	22-23	24-25	26-27	28-29	30-31	32-36
1960	5/111	1/88	12/149	11/45	11/27	11/16	4/12
1961	7/163	4/95	7/125	14/76	12/28	6/9	2/15
1962	0/114	4/161	3/91	30/121	2/19	5/9	0/7
1963	0/2	18/194	5/90	29/100	13/44	5/10	1/8
1964	--	15/208	13/159	17/68	14/62	5/10	6/7
1965	---	1/32	13/308	33/78	22/65	8/19	1/2
1966	---	--	15/298	29/120	10/46	14/36	0/4
1967	---	--	11/190	87/306	21/53	15/37	3/7
1968	-- -	--	1/15	113/427	26/82	14/29	8/17
TOT	12/390	43/778	80/1425	363/1341	131/426	83/175	25/79

COLONEL ATTRITION COMBINED YEAR GROUPS

YEAR	20-21	22-23	24-25	26-27	28-29	30-31	32-36
1960	.045	.011	.079	.244	.407	.688	.333
1961	.043	.042	.055	.173	.429	.600	.133
1962	.000	.025	.032	.244	.105	.556	.000
1963	.000	.093	.053	.279	.289	.500	.125
1964	---	.072	.081	.246	.222	.500	.857
1965	---	.031	.042	.402	.338	.421	.500
1966	---	.000	.049	.221	.217	.389	.000
1967	---	---	.058	.276	.382	.405	.429
1968	---	---	.067	.260	.313	.483	.471
MEAN	.031	.055	.055	.261	.304	.472	.316
S.D.	.028	.037	.016	.063	.105	.104	.233

COLONEL ATTRITION PROBABILITIES

YEAR	20-21	22-23	24-25	26-27	28-29	30-31	32-36
1964	7/55	129/824	19/106	8/46	7/26	8/14	3/6
1965	0/17	35/701	27/139	11/44	0/24	7/13	1/3
1966	4/32	21/207	104/652	9/69	7/27	11/17	2/6
1967	10/73	19/120	56/565	22/108	7/34	6/14	3/8
1968	12/135	19/162	47/213	92/288	16/59	17/21	3/8
TOTAL	33/312	223/2014	253/1675	142/555	37/170	49/79	12/31

LT. COL ATTRITION COMBINED YEAR GROUPS

YEAR	20-21	22-23	24-25	26-27	28-29	30-31	32-36
1964	.127	.157	.179	.174	.269	.571	.500
1965	.000	.050	.194	.250	.000	.538	.333
1966	.125	.101	.160	.130	.259	.647	.333
1967	.137	.158	.100	.204	.176	.429	.447
1968	.088	.117	.221	.319	.271	.810	.375
MEAN	.106	.111	.151	.256	.218	.620	.394
S.D.	.058	.045	.051	.086	.118	.144	.073

LT. COL ATTRITION PROBABILITIES

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DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1 ORIGINATING ACTIVITY (Corporate author)

Naval Postgraduate School
Monterey, California 93940

2a. REPORT SECURITY CLASSIFICATION
Unclassified

2b. GROUP

3 REPORT TITLE

Predicting Attrition of United States Marine Corps Officers by Rank and Military Occupational Specialty

4 DESCRIPTIVE NOTES (Type of report and inclusive dates)

Master's Thesis; April 1970

5 AUTHOR(S) (First name, middle initial, last name)

James Lewis Klingerman

6 REPORT DATE
April 1970

7a. TOTAL NO. OF PAGES
67

7b. NO. OF REFS
8

8a. CONTRACT OR GRANT NO.

b. PROJECT NO.

c.

d.

9a. ORIGINATOR'S REPORT NUMBER(S)

9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)

10. DISTRIBUTION STATEMENT

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11. SUPPLEMENTARY NOTES

12. SPONSORING MILITARY ACTIVITY

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Monterey, California 93940

13. ABSTRACT

This thesis develops a model for the prediction of officer losses from the United States Marine Corps. The model is developed through the analysis of past data. From this analysis, the thesis shows what prediction values are required in order to develop the model. Some calculations are made to show the nature and scope of the required predictors. The author recommends that an operational model be constructed in order to better estimate the value of this approach to officer personnel attrition prediction in the United States Marine Corps.

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Personnel Model						
Attrition						
Retirement Probabilities						
Manpower						